Program Abstracts

Pre-Conference Primer, Thursday, 9:00 a.m. - 12:00 p.m.

Crime Mapping Startup: What is Crime Mapping?

Elizabeth Groff and Mark Stallo. This three-hour workshop will explore the basics of crime mapping. Attendees will learn about the art of crime mapping and the central role of geographic information systems (GIS). Information will be given on how agencies can begin to use mapping to support patrol, investigations, administration, and strategic planning activities. Examples will be used to illustrate the capabilities and limitations of GIS as it relates to criminal justice. Attendees will be instructed on how to conduct an analysis of data using crime mapping and how to use this information towards effective decisionmaking. Various types of maps will also be examined, as well as guidelines for choosing the best map to display information. Presenters will also cover issues associated with accessing data sources. Constraining factors associated with crime mapping will also be discussed, as well as technological innovations on the horizon that support crime mapping efforts.

Plenary Panel—Innovative Applications, Thursday, 1:30 p.m. - 3:00 p.m.

***Catching Serial Rapists through Crime Mapping*, Robert D. Keppel.** Washington State's Homicide Investigation and Tracking System (HITS) is a computerized investigative program that collects, collates, and analyzes the characteristics of violent crime. Through internal computer programs, HITS records each offender's method of operation and compares those characteristics against all information in 26 databases containing over 15 million records. Information gathered by HITS about offenders, victims, weapons, vehicles, geographic locations, and relationships among cases is shared with law enforcement agencies. This enables them to compare information and evidence in order to identify and arrest violent offenders. Specifically, HITS uses crime mapping techniques to help detectives catch serial offenders and prevent further victimization. Several examples of the use of HITS data will be given, highlighting the solution of ongoing serial rape and serial arson cases.

***Enhancing Police and Community Access to Information,* Keith Harries.** This presentation argues that police departments, community organizations, and individuals should have access to a more broadly based archive of geographically referenced data, going beyond sources that have traditionally been regarded as adequate for police and community use. In addition to the data bank, visualization should be enhanced through the wider use of such resources as aerial and ground-level photography, videography, virtual reality imaging, and iconic maps. Such methods of presentation should generally reduce the level of abstraction in visualizations in order to make them more "real" as well as provide multiple perspectives on places and areas. When using such presentations, one can minimize problems associated with limitations on spatial perception by helping map readers more easily understand community spatial relationships. Orthophotographic presentations provide opportunities for better communication within the varied constituencies of police departments. Such

simplification of information will also enhance spatial data through the application of GPS technology and enrich the context of intelligence gathering. Furthermore, the power and flexibility of GIS should be exploited in order to customize maps for community audiences on the basis of group characteristics.

Mapping to Identify Places in Need of Intervention Programs: Three Examples from the Colorado Division of Criminal Justice, **Kim English.** The Division of Criminal Justice is the state criminal justice planning and policy analysis agency. This presentation shows several examples of how the Division has incorporated spatial analysis into research projects and simple mapping into program planning. Non-crime data elements, used in a criminal justice setting, are the focus of this presentation.

Concurrent Panels, Thursday, 3:15 p.m. - 4:45 p.m.

From Theory to Practice: Using Theory to Guide Mapping Efforts

(Repeats on Friday at 8:30 a.m.)

The Role of Theory in Crime Mapping, **Patricia L. Brantingham, and Paul J. Brantingham.** Modern microcomputer-based GIS systems have made it possible for police to generate simple crime maps with relative ease. Criminological theory can enhance the power of this tool for both strategic and tactical purposes by shaping the questions crime mappers ask and by providing a framework for envisioning street level police knowledge. The theoretical propositions of environmental criminology can be used in conjunction with crime mapping techniques to identify high risk locations, to model offender decisions, and to project an unknown suspect's activity anchor points. This can, in turn, provide better guides to deployment of crime prevention programs and patrol resources and can provide a useful tool in some types of investigations.

Maps that Make Sense: Using Theory-Based Maps, **John Eck**. Many crime maps are puzzling amalgams of symbols and shading that confuse viewers rather than lead them to an understanding of the problem. In part, this is because criminal justice practitioners face a bewildering array of options when it comes to mapping crime and disorder events. How does one decide what to map and how to map it so that it communicates effectively? Part of the answer is to rely on theories of crime and disorder. Using examples of retail drug dealing and crime hotspots, this session will illustrate the practical aspect of crime theory, particularly Routine Activity Theory and Environmental Criminology. Participants will see how theory-based maps draw attention to the heart of crime problems and facilitate effective actions.

ESRI Project: The Crime Analysis Tool Box

Building a Crime Analysis Application: A Presentation on Developmental Efforts, **Eleazer Hunt, Tracy Molfino, and Ezra Zubrow.** This panel will present the GIS-based crime analysis application developed under a cooperative agreement from NIJ. The panel will consist of personnel from the ESRI lead project team. The panel will make presentations in three areas: (1) overview, functionality, and a demonstration of the main application being developed; (2) discussion and demonstration of an electronic beat book and officer safety module; and (3) research results in the

development of advanced crime analysis tools. The application consists of an easy to use, integrated, out-of-the-box solution for crime mapping and analysis that is built for Windows NT 4.0, 95, and 98, and requires ArcView 3.1 and Spatial Analyst 1.1. This application contains a data loader wizard, basic and advanced tools for crime analysis, and user interfaces for patrol/detectives, crime analysts, and administrators. The concept behind the application includes a single PC installation that can make use of a LAN or WAN to access and store data and a tool box for crime analysis, which provides a suite of functions that cover 75-80 percent of an average user's crime analysis needs or map-based information analysis. The application will also assist agencies that are looking to upgrade existing crime analysis processes, assist in community oriented policing and problem oriented policing programs, and upgrade reporting and map production. Our target audiences for this application are small to medium-sized agencies that have little technical support for their GIS resources. The application will provide pin mapping and advanced analysis in the form of geo-statistical, multivariate statistical routines (predictive, spatial interpolation), as well as additional functions (crime analysis, statistics) to be added via ad hoc scripts or DLLs.

Base Maps: Access, Accuracy, and Usability

(Repeats on Saturday at 10:45 a.m.)

***Introduction to Digital Base Maps,* Kevin Davie.** This presentation targets the beginner and intermediate user who is interested in discovering what data may be available as base maps. Attention will be given to vector data such as street networks, private business and public service locations, plat maps and geographic boundary areas, and image data such as aerial photos, satellite data, elevation, and land cover data. The presentation will focus on appropriate uses and where to find base map data.

***Criteria for Useful, Effective Base Maps,* Frederick E. Westerfeld.** Current base map development projects now emphasize spatial accuracy and levels of detail that sometimes approach the standards of civil engineers and land surveyors. It is not obvious that this meets the needs of those using digital maps.

This presentation posits a different approach to digital map accuracy requirements. Users in the criminal justice field and other components of human services GIS are more concerned with map completeness and currency than with spatial precision. They need digital maps that incorporate all landscape features, are completely up to date, describe features in all ways that they are known to the public, and communicate that information in ways that are easily recognized. Digital maps meeting these needs should be the primary concern of map developers serving users in the crime mapping and crime analysis fields.

Digital map creation and maintenance should begin by selecting appropriate source data that recognize these performance requirements. Map production work should ensure that all locations identified by each source are built into end products. Characteristics of three major, but often unused, data sources for individual street addresses (real property files, E-911 telephone address lists, and USPS mail delivery files) are examined. Including these types of source information with other more widely used data sources will yield digital map files that closely meet the needs of users in all specialties of social services GIS.

Across Jurisdictions, Over Boundaries: Interagency Use of Crime Mapping

(Repeats on Friday at 3:00 p.m.)

***The Regional Crime Analysis System*, Peter D. Christensen and Ernie Crist**. Police agencies have recognized for decades that criminal activity does not occur exclusively within jurisdictional boundaries. Crime, and those who commit it, are aided by the freedom of mobility provided by transportation systems. Crime analysis systems allow police agencies to identify criminal activity according to its geographical, temporal, and modus operandi attributes, and to link known suspects with identified trends. Crime mapping facilitates trend identification and helps convey this information to users in an easy to understand manner. This presentation will describe the formation of the Regional Crime Analysis System and discuss how police analysts in the region use crime mapping.

***Orange County, California, Gang Incident Tracking System: An Example of Interagency Collaboration*, James W. Meeker**. Street gang turf boundaries and activities often don't coincide with the political boundaries that separate local municipalities. This is especially true in large areas of relatively high population densities that cross jurisdictional boundaries. Gang members often commit crimes outside the cities where they claim turf. Similarly, one community's efforts to discourage gang activities may do little more than push the problem into a neighboring jurisdiction. While it makes good sense for local governments and their agencies to band together to approach gang problems on a regional basis, such cooperative efforts are rare. This presentation recounts the experiences of over 30 municipalities that banded together to address gang problems in Orange County, California, a large metropolitan area with a very heterogeneous population of 2.7 million. The first step taken by Orange County law enforcement was the formation of the Orange County Gang Strategy Steering Committee to help coordinate the efforts of local law enforcement agencies, schools, and community groups. In order to develop impartial information about the nature and distribution of gang activities in the region, researchers at a local university were also brought in to assist in collecting and analyzing meaningful data on gang crime. While this effort represents a unique example of multi-jurisdictional law enforcement and university cooperation, it is not without its problems. Issues of what data to collect, and who has control or access to the data, can create difficulties and influence the utility of the database. The use of mapping technologies, which present cross-jurisdictional data, can be especially problematic.

Integrating Non-Crime Data: Where to Find It, How to Use It

(Repeats on Saturday at 9:00 a.m.)

***Integrating Non-Crime Data: Sources, Database Design, and Querying Methods*, Andreas M. Olligschlaeger.** Non-crime related sources of data can be a great asset for analysts and investigators wishing to interpret spatial patterns of crime. Examples of such sources include socioeconomic characteristics of areas and public sources of information such as property tax records, liens, and utility information. In addition, recent developments in geocoding techniques allow for the

integration of multimedia data sources such as newspaper articles, intelligence reports, speech recognized text and broadcast news.

This session discusses how to design relational databases in order to facilitate the integration of crime data with other sources of information via geographic links, both point- and polygon-based. The principles of database design will be discussed and examples of database designs will be shown that illustrate these concepts, including basic designs in Microsoft Access as well as more advanced designs involving distributed databases such as Oracle or Informix typically found in larger organizations. The use of non-crime related data will be demonstrated using ArcView. In addition, advanced geocoding techniques and the integration of broadcast news and speech recognized text will be demonstrated using Carnegie Mellon University's Informedia Digital Video Library project.

***The Traditional Misuse and Non-Traditional Use of Crime Mapping*, Gregory Saville.** Crime mapping data typically uses only information that is dated, partial, and of limited use. It shows the tip of the iceberg. This session will discuss these limitations and will suggest alternative forms of data, different ways in which crime mapping can be used, and new ways to think about non-traditional data. Discussed will be (1) the scale of crime mapping and the problem of ecological fallacy; (2) how to incorporate fear into crime mapping; and (3) what situational problem solving and small scale CPTED requires of crime mapping.

Crime Mapping Q&A

Elizabeth Groff and Mark Stallo. This panel will allow those who attended to the Crime Mapping Startup Pre-Conference Primer to ask questions and address concerns about getting started with crime mapping and analysis.

Concurrent Panels, Friday, 8:30 a.m. - 9:45 a.m.

Designing Your Own Front-End System: Lessons from the Pros

(Repeats on Saturday at 10:45 a.m.)

***Regional Crime Analysis Geographic Information System (RCAGIS),* John E. DeVoe.** The United States Department of Justice, Criminal Division GIS staff is currently developing a crime analysis application for regional use by police departments in the Washington, D.C. and Baltimore, MD areas. The Criminal Division is using its experience in developing an ArcView-based crime analysis application for crime analysts (called the Spatial Crime Analysis System) to develop a Map Objects-based application that is designed for regional use by police departments. The application is called the Regional Crime Analysis GIS (RCAGIS), and it promises to be a very powerful crime analysis, mapping, and reporting tool. RCAGIS will include three modules, one for police officers, one for crime analysts, and one for police managers.

RCAGIS builds on area police departments' success in establishing the Regional Crime Analysis System (RCAS). RCAS is a relational database program that resides on a centrally located server (accessed by dial-up connection). It includes established crime data standards and GIS crime analysis tools that allow users to access and study crime across jurisdictional boundaries. By targeting the individual (and sometimes overlapping) needs of police officers, crime analysts, and police

managers, and by accessing regional police department crime data, RCAGIS is expected to greatly facilitate police departments' tactical and strategic responses to crime.

***Overview of CrimeStat*, Ned Levine.** This presentation provides an overview of *CrimeStat*, a Windows NT/9x spatial statistics package used in crime analysis, developed with support from an NIJ grant. It is a series of statistical tests that can be used to describe crime distributions and interfaces with a geographic information system (GIS). The primary input is a collection of point locations, defined by their X and Y coordinates (e.g., crime incidents). *CrimeStat* can read ASCII, dbase ('dbf'), or ArcView 'shp' files and can output to ArcView, MapInfo, Atlas*GIS, Surfer, and Spatial Analyst. The point locations can be in spherical or projected coordinates and can be weighted or have associated intensity (Z) values. In addition, a secondary file of point locations can be included (e.g., police stations). *CrimeStat* also allows for a reference file, usually a grid, which can be either imported or generated by the program. Among the statistics that are included are those for describing the spatial distribution (e.g., mean center, standard deviational ellipse, spatial autocorrelation), angularity (e.g., directional mean and variance), properties of the arrangements of points (e.g., nearest neighbor distance), journey-to-crime estimates, "hot spots" (e.g., local Moran, K-mean clustering), and one- and two-variable kernel density surfaces (e.g., density of robberies, density of burglaries compared to population). The presentation will introduce the program and will illustrate some of the statistics.

***Providing Practical GUIs for Policing*, K. Michael Reynolds.** In order to develop practical graphical user interfaces (GUIs) for policing, the software developer must be prepared to merge two worldviews: that of the software engineer and law enforcement practitioner. The design challenges are not programming, but instead, basic communication issues between those who speak the language of computers and those who speak the language of policing. What would appear to be a relatively straightforward process can be one of countless revisions due to misunderstandings between software designers and police practitioners. To enhance the software GUI design process and reduce the non-productive expenditure of scarce resources, an interactive weekly meeting of key personnel is invaluable. These individuals must recognize the inherent communication difficulties and ensure the product development reflects a common understanding.

Cartography 101: Making Maps That Communicate

(Repeats on Saturday at 9:00 a.m.)

***Workshop in Basic Cartography*, Keith Harries and Joseph Szakas.** Through the use of numerous examples, this workshop will provide an introduction to the components that go into making a map, types of graphic symbols, and map design issues. The art and science of mapmaking, or *cartography*, is ancient, and crime maps represent a relatively new application of established methods. Cartography is a science with a body of theory and practice informing people how to place data accurately on the earth's surface. Cartography is also an art since maps are an abstraction of reality, and subjective decisions must be made about what will and will not be included, and about how data will be displayed. Initially, the analyst must decide whether a map is the most appropriate medium for communicating the necessary information; if the answer is "yes," then various decisions

must be made about piecing together the most useful map ingredients. Trade-offs must be made between simplicity and complexity in order to ensure that the product actually communicates what the analyst intends. Having GIS technology facilitates map making, but does not guarantee good maps. This workshop will help guide the analyst in the decisionmaking process to make maps that communicate clearly and effectively.

Improve Your Hit Rate: Data Integrity and Address Matching Issues

(Repeats on Friday at 3:00 p.m.)

Geocoding for Success, **Christopher S. Gebhardt.** In this session, users will learn the various ways to improve their geocoding success rates, also known as "hits." Different strategies will be examined including geofiles, geocoding, and dynamic address matching. Common techniques to improve the overall collection of address information will be discussed. Attendees will learn what other agencies are doing to achieve high success rates and how they can implement these policies in their own organization. The importance of geocoding 100 percent of all records will be stressed with examples. The presentation will conclude with assorted problems the speaker has noticed and overcome, including vacant lots, fields, highways, and the use of GPS.

Designing Out Mapping Problems: A Focus on Data Integrity Issues, **Lorraine Green Mazerolle.** This presentation examines technological approaches and offers practical tips for improving data integrity. Some of the issues covered include building geo-archives, blocking free-flowing CAD and MIS data entries, designing CAD and MIS systems with crime analysis in mind, cleaning and updating mapfiles, creating vertical maps, pre-coding data, creating common area geocodes, and conducting regular audits of system elements.

COPS and MAPS: GIS for Community Policing and Problem Solving

(Repeats on Friday at 1:15 p.m.)

Crime Mapping for Community Policing and Problem Solving, **Jeff Dean.** Crime mapping is one of the more recent tools being used by crime analysts and police officers in their problem solving efforts. Any type of geographic data can be mapped, including crime and arrest locations, gang boundaries, drug complaints, schools, banks, parks, and alcohol license locations. This session will cover several different ways that crime mapping can foster and assist community policing and problem solving. The participants will learn how maps can help identify, analyze, and assess a problem, different types of data and resources, and issues relating to mapping for the community. A variety of case studies and examples will be covered.

Automated Mapping and Alternative Policing Strategies, **Jonathan H. Lewin**. In this presentation, the Chicago Police Department's Information Collection for Automated Mapping (ICAM) system will be documented. This system provides department members access to a sophisticated, yet easy to use, crime mapping and analysis system. Designed by police officers and developed entirely in house, ICAM supports Chicago's Alternative Policing Strategy, known as CAPS. This strategy requires beat officers, working with the community and other city service providers, to be problem-solvers at the beat level. ICAM was designed to provide police officers

with the information they need to be effective partners in the problem-solving process. The department's future mapping plans will also be presented, including Command ICAM and Citizen ICAM. Command ICAM will provide information for command-level department members, while Citizen ICAM will provide interactive crime mapping capabilities via the web. These ICAM components all use client-server architecture and were developed using the latest industry standard tools.

The Use of Crime Mapping and Analysis by Community Organizations in Hartford, Connecticut, **Thomas F. Rich.** A project funded by the National Institute of Justice is under way to introduce crime mapping and analysis to community crime prevention organizations in Hartford, CT. This presentation will describe how this mapping capability has been provided to the community organizations and how it supports community policing and problem solving efforts in Hartford.

This project originated as part of Hartford's Comprehensive Communities Partnership (CCP) initiative, a city-wide effort aimed at expanding community policing, implementing community-oriented government, and mobilizing city residents around crime prevention and control. An important component of CCP involved forming problem-solving committees in each of the city's 17 neighborhoods. During an early CCP needs assessment, the problem solving committees identified access to computerized police databases as one of the most critical information requirements for effective problem solving. Providing this access could be accomplished in a number of different ways. Increasingly, police departments are publishing aggregate crime statistics on the Internet. A few departments publish incident-level crime information on the Internet, including the date, time, location, and type of crime. In Hartford, the objective was to go one step further and provide community organizations with their own basic mapping and analytical tools that could be used to analyze incident-level data.

The presentation will show how the mapping and analysis software has been used to date, including the overall level of use, the types of maps and reports produced, and how the maps and reports have been used. Some preliminary observations on the overall impact of the system on community organization effectiveness, perceptions of neighborhood safety, and police-community relations will also be discussed.

Intermediate Spatial Analysis

(Repeats on Friday at 3:00 p.m.)

Analytical Mapping**, Phil Canter**. Police departments are increasingly using computer mapping to assist in tactical and strategic planning and crime analysis. Most departments rely on descriptive maps to communicate information about crime locations. The ability to graphically display information about one or more case attributes, such as time or modus operandi, is useful in identifying crime patterns associated with offenders. A high concentration of point locations or a high count of incidents associated to boundaries may suggest clustering or "hot areas." The ability to associate crime with different map features, such as mass transit stops or schools, is useful in exploring relationships between crime and the built environment. There is another aspect to computer mapping, generally referred to as analytical mapping, which may be useful to police. Analytical mapping can involve developing continuous map surfaces from discrete point locations, identifying residences of serial

offenders, testing assumptions about the distribution of point locations, or exploring interaction effects between time and space. Analytical mapping may provide additional insight into the circumstances influencing crime. This presentation will discuss the use of analytical mapping as a complement to descriptive mapping within a police environment. The advantages and disadvantages of analytical mapping for policing will be discussed, including discussion on integrating analytical methods into geographic information systems designed for police use.

Crime Space/Time Series Analysis: Issues and Progress, **Wilpen L. Gorr.** Crime analysts need to understand and project trends in crime over space and time. The fundamental problem is to build models that are theoretically based and fit the crime data well over time and space contexts. This is difficult because of the small scale of police work; for example, because hot spots are only a few blocks in area and because of the richness of the behavior being modeled. This talk will address (1) the sources of variation in crime patterns (population characteristics, land use, and police interventions), (2) data sources (police, other administrative agencies, and commercial), (3) exploratory data analysis (mapping and animations), and (4) modeling approaches ("naive" time and space models, contiguity versus analogy-based data pooling, and leading indicator variables for prediction).

Plenary Panel—The Executive Perspective on Mapping for Police Operations, Friday, 10:00 a.m. - 12:00 p.m.

Risk Focused Policing: Mapping Risk Factors to Control Crime, **Chief Jim Bueermann**. In 1994, the Redlands Police Department simultaneously introduced community-oriented policing and problem solving (COPPS) and crime mapping to the citizens of Redlands. Since then, the department has merged both concepts within the theoretical framework of Risk and Protective-Focused Prevention (RPFP) to gain an understanding of the causes and prevention of adolescent problem behaviors such as substance abuse, delinquency, violence, dropping out of school, and teen pregnancy. The synthesis of COPPS and RPFP is called "Risk Focused Policing" and is defined as "a data and results-driven, community-oriented policing and problem solving strategy focusing on those factors in a community that place its youth and their families most at risk for criminal and other problem behaviors."

This strategy has led to the mapping of community, family, school, and peer group risk and protective factors at the neighborhood level, to help police serve as a catalyst for community transformation. In addition, it led to the merging of two city departments so that police, housing, recreation, and senior services are all in one department (police) to better facilitate the strategies necessary for substantive prevention and intervention efforts in the community.

The New York City Police Department's COMPSTAT Process, **Edward Norris.** In 1994, the New York City Police Department (NYPD) instituted a new managerial command and control system. The system grew out of the need to manage, monitor and assess the impact of the department's new crime control strategies and soon became known simply as "COMPSTAT," short for Computerized Crime Statistics. By 1996, the results attributed to the NYPD's new management

philosophy would make COMPSTAT a familiar term in criminal justice circles. By 1997, New York City's year-end FBI Uniform Crime Report statistics recorded a cumulative reduction of more than 41 percent compared to 1993, the year prior to COMPSTAT implementation, and gave the process national exposure. The trend has continued through 1998. No other major American city has recorded as significant or sustained a reduction in crime during any comparable period in the modern crime-reporting era.

The COMPSTAT process reestablished the importance of two powerful management concepts, accountability and analysis. Coincidentally, new technology, in the form of computerized mapping, provided a highly effective way to identify local crime problems, closely monitor the implementation of any proposed tactical response, and quickly assess impact.

The New York City Police Department's experience with the COMPSTAT process demonstrates that, to obtain the most significant impact from technological innovation, the technology must be integrated into the agency's mission and operational strategies. The COMPSTAT process is a management tool for quickly identifying problems, developing strategies and tactics, evaluating impact, and expanding and enhancing what works. Geographic Information Systems (GIS) technology plays an important role in these tasks and has made a real contribution to the department's success in reducing crime and disorder in New York City.

***Management Issues in Crime Mapping,* John Welter**. Crime mapping is being used throughout the United States as a modern-day tool in policing. The technology is improving at a rapid pace and can provide a wealth of information to those who view crime maps. What information is gathered and displayed, and how that information is applied to police work, can have a significant impact on the day-to-day operations of field level officers. It can also have a positive or negative effect on neighborhood residents. The San Diego Police Department (SDPD) believes in the philosophy of Neighborhood Policing and the strategy of street level problem solving. The agency promotes the use of as much crime related information as possible, for the street cop as well as the community resident. This philosophy and strategy may be in conflict with some agencies which believe crime mapping can be best used to hold command personnel accountable for crime in a given geographical area. Is there a conflict in the two methods? Does one use have priority over the other? Assistant Chief John Welter will discuss what the SDPD is doing with crime mapping and how the future of mapping is important to his organization.

Concurrent Panels, Friday, 1:15 p.m. - 2:45 p.m.

Successes in the Field: Crime Mapping Case Studies

(Repeats on Saturday at 10:45 a.m.)

***Auto Theft Problem in Newark, New Jersey,* Megan Ambrosio.** Auto theft has been a persistent crime problem in the city of Newark for several years. Various efforts have been attempted that have resulted in a marked decrease in auto theft activity. In 1989, the City of Newark averaged 44 vehicle thefts per day, whereas during this past year, the average rate is 13.8. Some strategies used in the past had short-term effects, but the persistent level of auto theft activity over several years indicated that those efforts were not making a lasting impact on reducing the rate. This presentation

discusses how the use of Comstat has aided in Newark's efforts to design and test various responses. The Comstat process has revealed that some strategies are more successful than others for long-term effects. The Comstat process includes the use of three types of maps: weekly auto thefts for a two-week period; auto thefts and recoveries for the same period; and recoveries only. In addition to the maps, tables that show sector by sector activity and the times of the thefts are reviewed for tactical purposes. Through this constant review of current data and maps, the police department is able to modify its strategies accordingly.

Case Studies in Geographic Profiling, **D. Kim Rossmo.** Geographic profiling is a police investigative methodology that analyzes the locations of a series of crimes (e.g., murder, rape, arson, robbery, etc.) to determine the most probable area of offender residence. This presentation briefly describes the theory, principles, and practice of geographic profiling. Two case studies are then discussed to show its application and utility.

During the fall of 1995, the Abbotsford Killer attacked two teenage girls walking to a party. In the wake of the attendant media publicity, he began a series of taunts to the police, including 911 telephone calls, acts of vandalism, and the theft of the victim's tombstone. These locations, in combination with the encounter and body dump sites, were successfully used as the basis for a geographic profile generated by the Rigel computer system. A local man was arrested and subsequently convicted of the crimes.

David Milgaard spent 23 years in prison for the 1969 sexual homicide of a nursing assistant in Saskatoon. Geographic profiling was one of several techniques used during a Supreme Court of Canada review of the case, initiated by the identification of an alternative suspect—a serial rapist operating in the neighborhood at the time of the crime. Milgaard's conviction was overturned and the rapist has now been charged with the 30-year-old murder.

Close the Door on Crime, **Susan Wernicke.** In April 1998, several divisions in the Overland Park Police Department (OPPD) noted a marked increase in the number of thefts from open garages (classified as residential burglaries). The units came together in a consolidated effort to combat the problem. Using statistics and maps provided by the Crime Analysis Unit (CAU), the department began a proactive approach to identifying the hardest hit area(s), informing the affected residents, and decreasing the suspects' opportunity to continue to "garage shop."

Armed with the maps pinpointing the locations of occurrences and a brochure designed specifically to address the open garage door burglaries, a group of officers contacted more than 1,200 residents over three months, advising each resident of the problem and how it could be combated. By simply asking the residents to close (and keep closed) their garage doors, the number of open garage door burglaries decreased from an all-time high of 14 incidents in June to only 1 incident reported in September 1998.

Geospatial Analysis of Rural Burglaries in Missouri, **David R. Wood.** The criminal intelligence analysts at the Mid-State Organized Crime Information Center (MOCIC) in Springfield, Missouri, routinely use analytical mapping or geospatial analysis to support approximately 900 federal, state, and local law enforcement agencies in a nine-state area. In one case in McLean County, analysts used residential burglary information to map and thus visualize the problem. The burglaries were analyzed

for frequency patterns by day, date, month, and sector in the county, and for proximity to main highways. These statistical summaries were useful in determining when and where the burglars were likely to strike next. Based on this spatial analysis, the McLean County investigators responded with tactical and operational adjustments that ultimately led to the apprehension of several suspects and subsequent cessation of burglaries in the jurisdiction.

Crime Mapping for Law Enforcement Managers

(Repeats on Saturday at 9:00 a.m.)

***Using GIS to Support Law Enforcement Management Decisions*, Richard C. Lumb**. This presentation will discuss and demonstrate the power of Geographic Information Systems (GIS) to support law enforcement management decisions such as identifying service needs, guiding resource allocation decisions, and assisting with the development of solutions to minor and major problems encountered by police agencies. The very nature of policing drives a reactionary response to demands for service. This need not be the case, as the "incident" to which police respond is but a piece of a chain of events that includes social and economic issues, density issues, ethnicity, and other identifiable variables. In combination, these variables provide the social structure in which crime and disorder may reside. This presentation will use actual cases where GIS played a major role in solving crimes and assisting in identifying and describing community problems. Managing police agencies into the 21st century will require a high order of requisite skills with tools such as GIS.

***Management Issues in Crime Mapping*, John Welter**. Crime mapping is being used throughout the United States as a modern-day tool in policing. The technology is improving at a rapid pace and can provide a wealth of information to those who view crime maps. What information is gathered and displayed, and how that information is applied to police work, can have a significant impact on the day-to-day operations of field level officers. It can also have a positive or negative effect on neighborhood residents. The San Diego Police Department (SDPD) believes in the philosophy of Neighborhood Policing and the strategy of street level problem solving. The agency promotes the use of as much crime related information as possible, for the street cop as well as the community resident. This philosophy and strategy may be in conflict with some agencies which believe crime mapping can be best used to hold command personnel accountable for crime in a given geographical area. Is there a conflict in the two methods? Does one use have priority over the other? Assistant Chief John Welter will discuss what the SDPD is doing with crime mapping and how the future of mapping is important to his organization.

Turfs, Networks, and Crime: Mapping Gang Problems

(Repeats on Saturday at 10:45 a.m.)

***Mapping Gangs: Research for Problem Solving*, Anthony A. Braga.** The experience, observations, local knowledge, and historical perspective of working police officers and others with routine contact with offenders, communities, and criminal organizations may represent an important underused resource for describing, understanding, and crafting interventions aimed at crime problems. Mapping and other information collecting and ordering techniques, usually aimed at formal police data, can also be used to good effect to capture and organize these experiential assets. This paper

describes exercises carried out as part of problem-solving policing projects designed to reduce gang-related homicide and firearms violence in Boston, Minneapolis, and Baltimore.

Gang Turf and Political Turf: Mapping Gang Incidents Across 30 Municipal Boundaries, **Bryan Vila**. In many areas of the country, street gang turf boundaries seldom coincide with the political boundaries that separate local municipalities. Gang members often commit crimes outside the cities where they claim turf. Similarly, one community's efforts to discourage gang activities may do little more than push the problem into a neighboring jurisdiction. Despite the political turf issues involved, it makes good sense for local governments and their agencies to band together to approach gang problems on a regional basis. This presentation demonstrates the ways in which regional mapping of gang incidents has been used by over 30 municipalities in Orange County, California, a large metropolitan area with a very heterogeneous population of 2.7 million.

Several examples of ways in which crime mapping can be used to help understand and respond to gang crime will be discussed. First, we will look at the use of crime mapping to look at changes in the spatial distribution of various types of gang crime across both jurisdictional boundaries and across time. Second, uses of mapping for delineating gang territories and gang incidents and the use of buffer zones to evaluate problems around schools will be discussed. Third, we will review the utility of hotter-than-expected and colder-than-expected analysis to identify special problems and potential solutions. We will also explore the use of digital orthophotographic images to explain the distribution of gang crime. Finally, we will look toward future opportunities to use gang incident mapping to guide civil abatement procedures, evaluate the effectiveness of alternative gang prevention, intervention, and suppression programs, and develop a tactical version of the crime mapping system that can be used by line officers throughout the region.

Crime Mapping Research Applications I

***Using GIS for Analyzing the Police Operations*, James L. LeBeau.** Presently, the most popular application of GIS has been for analyzing crime specific events. This presentation discusses the application of GIS for describing and analyzing calls for police services and issues related to the patrol function. Some of the issues discussed and illustrated include: mapping out hazardous spaces; measuring, visualizing, and mapping out cross-beat dispatching; monitoring specific types of places; and creating new kinds of maps for visualizing the spatial distribution and patterns of different types of calls for service. The site for this research is the Charlotte-Mecklenburg County, North Carolina, Police Department.

Mapping Repeat Residential Burglary Victimization in Detroit: Implications for Policing, **David Martin.** While we have known that crime is not evenly distributed in urban communities, only recently has the issue of repeat victimization and its effect on overall crime rates been recognized. Repeat crime victimization is the repeated victimization of the same persons, places, and objects. Repeat victimization is common among burglary victims. Research has shown that once a house has been burglarized its chance of repeat victimization is four times the rate of houses that have not been burglarized before. The results of some recent studies indicate that special strategies focusing on repeat victimization may, for certain types of crimes such as burglary and domestic violence, be

effective means of substantially reducing the overall level of crime in a community. Police strategies to address repeat victimization may be assisted by mapping and research framed in criminological theory. One theory argues that a crime occurs upon the interaction of three factors: (1) a motivated offender, (2) a suitable victim, and (3) the absence of a capable guardian. Thus, neighborhood crime rates will be affected by changing one or more of these factors.

***Comparing Alternative Methods for Understanding Spatial Patterns of Crime,* John Mollenkopf.** Researchers have sought to understand how best to display and analyze clusters of crimes, to determine when a cluster has reached significant proportions, and to analyze change over time. Our research group has explored several methods for addressing these issues, including spatial smoothing and aggregation at the block level. Using the same data, the results of each of these methods will be presented and their strengths and weaknesses assessed.

Mapping and the Web

(Repeats on Saturday at 10:45 a.m.)

***Mapping and the Web*, Maria MacGunigal and Julie Wartell.** Crime mapping is becoming more and more popular in law enforcement agencies across the country. Internet technology and availability has exploded in the last few years. With the growth in community policing, many jurisdictions are now making crime data and maps available on the Web. Most often, these are generated by the police department, but in addition, several newspapers and neighborhood associations are jumping on the bandwagon.

There are many issues surrounding crime mapping on the Web. These include currency of data, cartographic principles, and legal and political ramifications. Many law enforcement agencies have dealt with some of these issues or will need to as they expand their Web sites. This session will highlight the experiences of two cities that have put crime maps on their Web pages. In addition, the presenters will show a wide variety of examples of crime maps currently on the Web. Finally, this session will have a facilitated discussion about the issues raised during the presentations.

Concurrent Panels, Friday, 3:00 p.m. - 4:30 p.m.

Crime Mapping Research Applications II

***Mapping Out Displacement and Diffusion*, Justin Ready**. With the growing knowledge that place-specific interventions can have an impact on crime and disorder, criminologists have increasingly turned their attention to the issues of crime displacement and the diffusion of crime control benefits. Although researchers often provide anecdotal accounts of one or both of these phenomena resulting from community policing programs, less attention has been paid to how to empirically measure spatial or other forms of displacement and diffusion. Drawing from a field study supported by the National Institute of Justice (principal investigator, David Weisburd; co-principal investigators, Rosann Greenspan, John Eck, and Frank Gajewski), this presentation examines some of the ways that mapping techniques are being employed to select sites and measure behavioral variations across areas of violent crime and prostitution. The discussion explores methods of linking official and observational data to street segments and larger areas to develop more accurate measures of neighborhood change.

It also discusses how computer mapping can be used to conceptualize and test competing theories of crime displacement.

***The Development and Use of High-Definition Geographic Information Systems*, George F. Rengert.** Geographic Information Systems (GIS) have the capability of recording and analyzing crime at both the macro and micro scales. To date, most of this analysis has been at the macro scale of a city or county. In this case, crime is plotted either without an environmental backdrop or on streets depicted by single lines. The spatial patterns that result are often difficult to interpret and can be misleading. For example, crimes occurring in multi-story buildings are aggregated to a single address, resulting in overlapping symbols, which are difficult to identify. Also, except for the street lines, there is no environmental backdrop depicted that may be related to the pattern of crime occurrences. Micro scale high-definition GIS allows crime to be mapped and analyzed where it occurs (including on the floors of multi-story buildings) and to be related to the characteristics of the surrounding environment.

The new technology included in high-definition GIS requires major modifications of traditional systems but provides unique advantages. For example, traditional GIS portrays a street as a single centerline, and crimes are plotted on either side. High-definition GIS portrays streets by their curb lines and specifically defines sidewalks: the line in traditional GIS becomes two parallel lines in high-definition GIS. As a result, investigators can no longer use TIGER files without modification for address matching. The most important advantage of high-definition GIS is that it allows analysts to evaluate situational crime control while avoiding "false hot spots" that may misdirect attention. At present, several projects are in the development phase. The Temple University project is described in this presentation.

***Virtual Reality Modeling Language: A New Tool for Crime Mapping*, Arvind Verma.** The recent developments in methodology and technology are opening some exciting crime mapping tools. The utility of crime maps both for law enforcement purposes and criminological inquiries has been restricted because of the inability to present more than a limited amount of data. The present stage of crime mapping is limited to simple, static two-dimensional images in which it is impossible to display more than a few crime types and incidents without cluttering the viewing space. However, current developments in computer graphics are providing new techniques that can address these shortcomings. This paper introduces to criminal justice practitioners the Virtual Reality Modeling Language (VRML), which enables the animation and investigation of complex crime maps from different perspectives. VRML is a technique that allows the user to examine a map conveniently by walking around or flying through it, as if it were a small object held at arm's length. This process enhances the understanding of the map significantly by offering a feeling of reality beyond a picture on the computer screen. This presentation demonstrates the usefulness of VRML by presenting a variety of crime maps and the possibility of animation. VRML techniques are discussed that permit the user to navigate through the maps by translating, rotating, zooming, and tilting them to gain better understanding of the data. Several applications based upon the VRML are also suggested for criminal justice practitioners.

Mapping from Around the World

***Mapping Business Crime, a Case Study for Merseyside, England,* Kate Bowers.** The mapping and geographical referencing of crime data has been used in the county of Merseyside, England, to identify both areas and individual properties that suffer from high levels of business crime. The types of business crime examined include non-residential burglary, criminal damage, theft by customer, employee theft, and robbery.

This information has been cross-referenced with contextual information to establish the characteristics of areas with high levels of different types of business crime. Among this contextual information is a novel system of classification of non-residential areas, produced using factor analysis. This categorizes the census tracts of Merseyside into non-residential areas such as "large area agricultural practices," "larger commercial centers," or "accessible, residential-based businesses." The effectiveness of such a classification at identifying areas that suffer from high levels of different types of non-residential victimization will be discussed.

Further research examines the relationship between levels of non-residential burglary, levels of repeat non-residential burglary, and levels of deprivation as measured by the government's Index of Local Conditions. Research has established that more deprived areas suffer from higher rates of domestic dwelling burglary and repeat domestic dwelling burglary than more affluent areas. These relationships are explored for non-residential burglary.

The discussion will also cover the use of geographically referenced crime information in the targeting and evaluation of a crime prevention initiative aimed at reducing the vulnerability of businesses on Merseyside. This will demonstrate how such information can be used in the decisionmaking process that is involved in the implementation of a crime prevention initiative.

***Exploring the Use of GIS for Operational Policing and Community Safety Initiatives: Examples from London, England,* Spencer Chainey.** The use of geographical information systems for crime mapping and crime pattern analysis is rapidly increasing across London's local government boroughs and its Metropolitan Police Force. This presentation will present some of these applications, showing where crime mapping is helping local authorities and the police target resources to reduce crime and disorder. Crime data is also being analyzed with information describing the physical, social, and economic geography of areas in an attempt to provide some of the clues as to why crime may occur. The presentation will also discuss the experience of implementing crime mapping systems, the role of partnerships between agencies, and the delivery of crime and disorder data to assist wider agendas tackling social exclusion and deprivation.

***Crime Mapping in Malaga, Spain,* Per Stangeland**. Malaga is located on the Southern Coast of Spain. It is an ancient city that has experienced an explosive population growth over the last decades, with a present population of approximately 550,000 inhabitants. This study analyzes crime data from two different police forces, jointly with data from a victim survey, geo-mapped to streets and street numbers on a digitalized city map. Crime data can also be combined with some basic demographic information on the district level. ArcView 3.0 is used as a research tool. At present, researchers are struggling with many minor inconsistencies in the police databases, due to sloppy classification of events and incomplete data. The goal is to test some hypotheses on crime hot spots and crime

prevention, and, at the same time, to develop an operational tool for the police forces. It could also be interesting to compare our data with some U.S. cities of the same size.

Training Opportunities and Resources

***GIS Training Opportunities*, Julie Wartell and Noah Fritz.** Law enforcement agencies are increasingly interested in using geographic information systems (GIS). In two recent surveys done by the National Institute of Justice and the Urban Institute at the University of North Carolina at Charlotte, a large percentage of responding agencies indicated they have recently started using GIS or are interested in learning more about GIS. Even if one looks to the expanding number of law enforcement agencies displaying crime maps on the World Wide Web over the last few years, it is clear that more and more agencies are using the capabilities of GIS to some degree.

Interest, however, does not always equate to adequate knowledge about how a new technology can enhance your goals, and so training is often desirable. Until recently, no GIS training existed that specifically focused on its uses within law enforcement. In response to agencies' growing need for improved resources for training in the area of crime mapping, three groups have developed a training series in GIS for law enforcement and public safety. This panel will highlight these three training opportunities. During the course of the session, each panelist will discuss the types of training available, provide an overview of course material that has been developed, highlight particular needs that are addressed for the law enforcement audience, and describe plans for availability and additional training in the future.

***Training Delivery by Carolinas Institute for Community Policing*, Deborah Thomas and Ed Delaney.** The Carolinas Institute for Community Policing (CICP) is the Regional Community Policing Institute (RCPI) funded by the U.S. Department of Justice's Community Oriented Policing Services (COPS) Office for North and South Carolina. CICP provides training to police, sheriffs, military police, and community members. Each RCPI provides a training specialty. CICP's specialty area is GIS, emphasizing crime analysis and problem solving through GIS and computer mapping. A two-track approach to GIS training has evolved, with technical courses for crime analysts, and non-technical courses to assist police and sheriffs to communicate effectively with crime analysts. In its first year, 1998, CICP delivered courses focused on non-technical users, command staff, organizational issues, and general community policing. Learning from the experiences of the first year, CICP is offering an ambitious suite of courses in its second year.

Concurrent Panels, Saturday, 9:00 a.m. - 10:30 a.m.

STAC (Spatial and Temporal Analysis of Crime) Workshop

Carolyn Rebecca Block, Richard Block, and Daniel Higgins. When it is initially acquired, computer mapping technology is a tremendous boon to crime analysts and local problem solvers. No longer is it necessary to draw maps by hand. All too soon, however, the amount of mapped information becomes too much to handle, many alternative summaries of it are possible, and quick decisions become more and more out of reach. In such situations, an efficient and objective summary of reality provided by statistics and spatial analysis can offer a useful guide to interpretation. Statistics

are tools designed to summarize enormous amounts of information and to organize that information to answer specific, practical questions.

But tools for organizing and analyzing spatial data are still in their infancy, particularly tools that are applicable in practical situations. STAC (Spatial and Temporal Analysis of Crime) was developed to help crime analysts and other problem solvers use mapped data. It is a toolbox of spatial analysis statistics designed to support practical law enforcement decisions. STAC is a stand-alone spatial analysis package, not a mapping package. It was developed by the Illinois Criminal Justice Information Authority with the collaboration of STAC users around the world, and is available from the Authority at no cost to law enforcement agencies. In this panel, we will provide an overview of STAC, demonstrate STAC with different kinds of data and different kinds of maps, show you some of the highlights of STAC for Windows, and ask you for your ideas and suggestions to make STAC better.

Crime Mapping Research Applications III

The Effect of "Crime" Gun Prevalence on Gun Assault and Homicide Rates, **Jacqueline Cohen (co-author, Piyusha Singh).** The effect of gun prevalence on violence is a subject of considerable debate among researchers and policy analysts. While some studies find that gun prevalence affects the incidence levels of violence, few studies focus specifically on prevalence of "crime" guns. We assess the impact on gun assaults and homicides of two reasonably direct indicators of crime gun prevalence in a city. Shots fired incidents measure varying levels of access to and willingness to use guns in a criminal manner, while the number of guns reported stolen gauges the levels of guns available through criminal distribution networks. Using data on neighborhood and time variations in crime gun prevalence in one city, we find evidence that increased access to crime guns selectively affects some types of gun violence and not others. Newly emerging forms of youth gang violence have been especially susceptible to influence.

Mapping Child Abduction, **Robert D. Keppel.** This presentation examines the use of distances in child abduction murder investigations using the Washington State Attorney General's Homicide Investigation and Tracking System. The data represented cases from 44 states and 419 killers of children under the age of 18 years. It was discovered that a unique pattern of distance relationships existed in child abduction murder investigations. The initial contact site was within 1/4 mile of the victim's last known location in 80 percent of cases. Conversely, the distance between the initial contact site and the murder site increased to distances greater than 1/4 mile (54 percent). The distance from the murder site to the body recovery site again decreased, to less than 200 feet in 72 percent of cases. There are investigative implications of these and other spatial relationships discovered in the research. For example, if the initial contact site is not identified by the police, the clearance rate drops drastically, and vice versa. The close proximity between the initial contact site and the victim's last known location suggests that a thorough neighborhood canvass and area search be completed to locate the initial contact site. The presentation will highlight these implications as they are applied to crime mapping applications and will demonstrate how having data enhances the crime mapping efforts to assist investigators in solving abducted child murder cases.

High Volume Crime and Hot Spots: Evaluating the Intelligence Dissemination Process, **Jerry Ratcliff.** A police manager often has to cope with high crime rates and a limited number of available police officers. It is important, therefore, that managers ensure their officers are patrolling the right areas and that they have a good knowledge of the crime hot spots on their beat. This is especially true in high volume crimes, which are often local crime prevention priorities. Crime mapping is one of the most effective methods of communicating the location of high volume crimes such as auto crime and burglary. Often, however, these types of crime are recorded by the same officers who are responsible for local crime prevention and patrolling. Is it possible that in identifying local hot spots, crime mapping systems are telling them something they already know?

This study addresses the question by surveying officers in one division of Nottinghamshire Constabulary (UK) and mapping their perceptions of crime hot spots with a GIS. This information is then compared to actual hot spots extracted from the crime data. LISA (Local Indicators of Spatial Association) statistics are used to define a statistically significant limit on the size and shape of the hotspots, allowing for a simple binary classification (hot spot/not hot spot).

The results show that on a local level there are implications for Nottinghamshire Constabulary in the areas of crime recording and the passage of information. More importantly, this type of project can be used to gauge the effectiveness of intelligence dissemination methods and to assess the areas where crime mapping can have the greatest impact. It can also be used over a longer term to evaluate current crime mapping systems and identify possible areas for improvement.

Crime Mapping Research Center's Hot Spot Project

A Multi-Method Exploration of Crime Hot Spots: A Synthesis of Findings, **Eric S. Jefferis and Cynthia A. Mamalian.** In recent years, crime analysts and researchers have become immersed in the identification of crime "hot spots." Largely, this upsurge in interest has been sparked by the increasingly powerful desktop mapping and spatial analysis software packages that are now available. This presentation will synthesize the findings of a collaborative project that involved a systematic comparison of hot spot identification tools found in several of the available packages. Among the comparisons being made are the packages' (1) accuracy, (2) consistency, (3) face validity, (4) utility for statistical analyses, and (5) "user friendliness."

Advanced Post-Conference Workshops, Saturday, 1:30 p.m. – 3:30 p.m.

Using GIS for Predictive Modeling

Predictive Modeling and Crime Mapping, **Donald E. Brown.** Law enforcement agencies have increasingly acquired database management systems (DMBS) and geographic information systems (GIS) to support their law enforcement efforts. These agencies use such systems to monitor current crime activity and develop collaborative strategies with local communities for combating crime. However, in general these strategies tend to be reactive rather than proactive. A more proactive approach requires early warning of trouble with sufficient lead-time to formulate a plan. Early warning, in turn, necessitates the development of predictive models in space and time that can inform law enforcement of pending "hot spots" and areas with declining crime activity.

The focus of this presentation is on the prediction of hot spots, as well as crime events. Prediction of this sort is now feasible because of modern data collection and analysis systems. Records management systems implemented in DBMS and GIS exist in many jurisdictions and can provide the basis for more formal analysis of local crime events. The formal analysis discussed consists of mathematical models that describe the functional relationships between demographic, economic, social, victim, and spatial variables and numerous measures of criminal activity. This presentation describes one approach and shows its applicability to crime analysis.

Implementing Chaotic Cellular Forecasting: Data Collection, Programming, and Visualization of Results, **Andreas M. Olligschlaeger.** The recent change in emphasis from reactive to proactive law enforcement as evidenced in programs such as community oriented policing has resulted in the need for tools to support these efforts. While geographic information systems (GIS) have been very successful at tracking criminal activity, proactive law enforcement requires systems that anticipate the emergence of criminal activity. A prototype of such a system was developed at Carnegie Mellon University and the Pittsburgh Bureau of Police. It is an early warning system that incorporates a geographic information system previously developed to track criminal activity and a relatively new technology—artificial neural networks—to predict the emergence or "flare ups" of drug hot spot areas. The system obtains its input from cell-aggregated GIS-based data, processes it with a previously trained artificial neural network, and outputs the results to a choropleth map indicating those areas for which the network has predicted a relatively high number of 911 calls for service for drugs. This session focuses on the issues involved with implementing such a hardware system, from data collection and programming to implementation and visualization via GIS.

Advanced Cluster Analysis

***Advanced Spatial Clustering Methods*, Sara McLafferty.** Spatial clustering methods are important tools for the mapping, visualization, and analysis of crime data. Capitalizing on the power and display capabilities of geographic information systems, clustering methods can assist police departments in identifying crime hot spots and assessing change in hot spots over time. This presentation reviews a series of spatial clustering methods that are increasingly being shown to have value for crime hot spot mapping. The methods include kernel estimation, a method for representing crime patterns as a density surface, and several methods that can be used to detect clustering in space and time and in relation to crime opportunities/targets. Technical and logistical challenges in implementation are discussed.

Advanced Crime Pattern Analysis Using the Geographical Analysis Machine, **Ian Turton (co-authors, Stan Openshaw and James Macgill).** This presentation will give an introduction to automated crime pattern hot spot detection using methods that are easily accessible with a very short learning curve. The majority of the presentation will focus on the Geographical Analysis Machine (GAM). The presentation will conclude with a brief discussion of other related methods developed at the CCG. The GAM (Openshaw, et al., 1987, 1988) was an early attempt at automated exploratory spatial data analysis that was easy to understand. The GAM sought to answer a simple practical question—namely, given some point referenced data of something interesting, WHERE might there be

evidence of localized clustering if you do not know in advance where to look due to lack of knowledge of possible causal mechanism, or if prior knowledge of the data precluded testing hypotheses on the database? More simply put, here is a geographically referenced database; now tell me, are there are any clusters or crime hot spots, and if so, where are they located? It offers a solution to those researchers and users of GIS who want to perform a fast exploratory geographical analysis of their data with a minimum of effort. It is an automated procedure that is designed to yield safe results that are largely self-evident.

GAM reflects the view that useful spatial analysis tools have to be able to cope with both the special nature of spatial data and end-users who do not have degrees in statistics. The results also have to be easily understood and self-evident so they can be readily communicated to other non-experts. This need has been clearly expressed as follows: "We want a push button tool of academic respectability where all the heavy stuff happens behind the scenes but the results cannot be misinterpreted" (Adrian Mckeon, Infoshare: email: 1997). There is also a requirement for results expressed as pretty pictures rather than statistics.

GAM has been further developed to produce the Geographical Explanations Machine (GEM) that attempts to "explain" in a geographical way associations between hot spots and other GIS data coverages such as socio-economics and other geodata.

Further developments have been made recently to improve the search methods used in GAM/GEM, since as dataset sizes grow, it becomes computationally infeasible to exhaustively search the entire data space. Two of these new search techniques will be briefly discussed. The first, MAPEX, uses a genetic algorithm to control the search, which reduces the search times by an order of magnitude compared to GAM. The second is a more experimental method using smart agents to explore the dataset in an intelligent manner.

Advanced Spatial Analysis

Extended Workshop, CrimeStat Package, **Ned Levine.** *CrimeStat* is a Windows NT/9x spatial statistics package for use in crime analysis. It is a series of statistical tests that can be used to describe crime distributions and interfaces with a geographic information system (GIS). The primary input is a collection of point locations, defined by their X and Y coordinates (e.g., crime incidents). *CrimeStat* can read ASCII, dbase ('dbf'), or ArcView 'shp' files and can output to ArcView, MapInfo, Atlas*GIS, Surfer, and Spatial Analyst. The point locations can be in spherical or projected coordinates and can be weighted or have associated intensity (Z) values. In addition, a secondary file of point locations can be included (e.g., police stations). *CrimeStat* also allows for a reference file, usually a grid, which can be either imported or generated by the program. Among the statistics that are included are those for describing the spatial distribution (e.g., mean center, standard deviational ellipse, spatial autocorrelation), angularity (e.g., directional mean and variance), properties of the arrangements of points (e.g., nearest neighbor distance), journey-to-crime estimates, "hot spots" (e.g., local Moran, K-mean clustering), and one- and two-variable kernel density surfaces (e.g., density of robberies, density of burglaries compared to population). The program will be demonstrated and detailed examples will be presented that illustrate and explain these statistics.